

MassDEP  
Bureau of Air and Waste

**Draft 2014 and 2015 Greenhouse Gas (GHG) Emission Factors to be used by  
Retail Sellers of Electricity Reporting under 310 CMR 7.71(9)  
“Reporting Requirements for Retail Sellers of Electricity”**

Regulatory Authority:  
M.G.L. Chapter 111, Sections 142A through 142E  
and Chapter 21N, Section 2(a)

May 2017

## Introduction

This document and the attached spreadsheets explain:

- the regulations requiring retail sellers of electricity to report greenhouse gas (GHG) emissions;
- the draft 2014 and 2015 emission factors (EFs);
- the data sources and methodology used to calculate the draft initial EFs;
- the methodology used to calculate the draft final EFs;
- the deadlines for public comment; and
- the process to be used to determine final 2014 and 2015 EFs.

The posting of this document and the attached spreadsheets on the website of the Massachusetts Department of Environmental Protection (MassDEP) triggers a 30 day public comment period for each spreadsheet, ending at 5 pm on June 26, 2017. By that deadline, any person may comment on the methodologies, data sources or calculations used to determine the draft initial EFs for each emissions year.

Comments on these EFs must be sent to Sue Ann Richardson at [sue.ann.richardson@state.ma.us](mailto:sue.ann.richardson@state.ma.us) or MassDEP, One Winter Street, Boston, MA 02108 by the 5 pm June 26, 2017 deadline.

## Background

The Massachusetts Global Warming Solutions Act (GWSA) requires “reporting of greenhouse gas emissions from generation sources producing all electricity consumed, including transmission and distribution line losses from electricity generated within the commonwealth or imported from outside the commonwealth; provided, however, that this requirement shall apply to all retail sellers of electricity, including electric utilities, municipal electric departments and municipal light boards...”<sup>1</sup>

This requirement is implemented through chapter 310 of the Code of Massachusetts Regulations (CMR), subsection 7.71(9) “Reporting Requirements for Retail Sellers of Electricity,”<sup>2</sup> as amended in March 2012, which requires each retail seller of electricity to annually report to MassDEP its megawatt hours sold, and associated GHG emissions released in the course of generating that electricity.

“Retail Seller” means a competitive supplier licensed by the Department of Public Utilities or, as each is defined in Massachusetts General Law (MGL) chapter 164A §1, an electric utility, municipal electric department or municipal light board.

The GHGs emitted from power plant smokestacks during combustion of fuels to generate electricity are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). The regulation requires retail sellers to report biogenic and non-biogenic GHG emissions separately. Biogenic GHG emissions means emissions of CO<sub>2</sub> that result from the combustion of biogenic (plant or animal) material, excluding fossil fuels. Non-biogenic GHG emissions include CO<sub>2</sub> released from the combustion of non-biogenic fuel, plus CH<sub>4</sub> and N<sub>2</sub>O released from the combustion of any fuel.

## Determining Annual GHG Emissions

Retail seller GHG emissions are to be determined by multiplying:

- Final EFs supplied by MassDEP each year for biogenic and non-biogenic GHG emissions (pounds carbon dioxide equivalents<sup>3</sup> per megawatt hour, or lb CO<sub>2</sub>e/MWh), by

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<sup>1</sup> See M.G.L. Chapter 21N, Section 2(a)(5) at <http://www.mass.gov/legis/laws/seslaw08/sl080298.htm>.

<sup>2</sup> <http://www.mass.gov/eea/agencies/massdep/air/regulations/310-cmr-7-00-air-pollution-control-regulation.html#1>

<sup>3</sup> Not all GHGs have the same heat-trapping capacity. For example, one pound of methane is equivalent to greater than 20 pounds of CO<sub>2</sub> with respect to their heat trapping potentials. To account for these differences, a standard relating the heat trapping potential of each GHG to an equivalent quantity of CO<sub>2</sub> over a given time horizon, has

- Annual electricity consumed by customers in a particular calendar year, increased to account for the portion of electricity lost during transmission and distribution (“line losses”) (megawatt hours, or MWh).

Later sections of this document explain how draft 2014 and 2015 EFs were calculated. MassDEP seeks public comment on the methodologies, data sources, or calculations used to determine the draft initial 2014 and draft 2015 EFs. Once final 2014 and final 2015 EFs have been determined, they will be used by retail sellers to determine 2014 and 2015 GHG emissions as described in this section.

In implementing the basic approach of reporting GHG emissions based on multiplying EFs by the MWh consumed by a retail seller’s customers, MassDEP requires that retail sellers rely on existing sources of MWh data. In particular, retail sellers subject to the Massachusetts Department of Energy Resources’ (DOER) Renewable Portfolio Standard (RPS) regulations at 225 CMR 14.00 and 15.00 are required to use the same MWh for their compliance with RPS for reporting their GHG emissions. This value is already reviewed by DOER, and it makes sense for retail sellers and MassDEP to rely on the efforts of suppliers and DOER to verify this value, and not duplicate that work. Similarly, Massachusetts electric departments and light boards, while not subject to RPS, are required to report the MWh consumed by their customers in an “annual return” to the Massachusetts Department of Public Utilities (DPU).<sup>4</sup> MassDEP is requiring these retail sellers to use the MWh they report in their “annual return” on page 57, line 15, minus any MWh they report on page 57, line 18, as sales for resale,<sup>5</sup> to calculate their reported GHG emissions. Line losses are included in the MWh reported to DOER for the RPS and to DPU for the annual return, and use of these MWh sources therefore complies with GWSA’s requirement that GHG reporting by electricity sellers include “transmission and distribution line losses.”

As explained further in BWP AQ 31 “Optional Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity” and its instructions, a number of adjustments to the basic approach are allowed in order to account for the ownership and/or use<sup>6</sup> of particular generation sources by certain retail sellers. MassDEP has attempted to keep this adjustment process simple in order to encourage providing credit to electric sellers for their clean electricity purchases. Allowing individual retail sellers to make adjustments in their GHG reporting affects the EFs representing the remaining MWh consumed in Massachusetts. Specifically, once individual retail sellers “take credit” for non- or low-emitting MWh, EFs must be recalculated based on the emissions of the remaining MWh consumed in Massachusetts, to ensure accuracy and avoid double counting. The final EFs to be used by retail sellers for the remaining MWh will likely increase, since presumably most retail sellers choosing to make adjustments will make that effort only for electricity with lower EFs than the overall Massachusetts EFs, effectively removing clean MWh from the calculation of the final EFs for the remaining MWh consumed in Massachusetts. Thus, submittals of BWP AQ 31 “Optional Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity” are used for two purposes: to allow an individual retail seller to account for ownership and/or

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been developed. Emissions shown in this document continue to utilize this standard, and are expressed in units of pounds of carbon dioxide equivalent (CO<sub>2</sub>e) as updated in IPCC’s Fourth Assessment Report (AR4). Retail seller EFs from 2008 through 2013 used the earlier IPCC Second Assessment Report (SAR).

<sup>4</sup> Annual Return Form AC-19 for municipalities can be found at

<http://www.mass.gov/eea/docs/dpu/restruct/competition/munformmac19.xls>.

<sup>5</sup> The MWh reported on page 57, line 18, as sales for resale should be subtracted from the total MWh reported on line 15, as these MWh are sold again through another retail seller of electricity and should therefore not be counted as part of the first retail seller’s load.

<sup>6</sup> For example, if a retail seller owns a hydroelectric plant and supplies the MWh from that plant to its customers, it may choose to submit BWP AQ 31 “Optional Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity” to take credit for the non-emitting hydroelectric power, rather than multiplying those MWh by the final EFs.

use of particular generation sources, and to modify the annual EFs used by retail sellers to report annual GHG emissions associated with MWh that are not reported on Form AQ 31.

### **Reporting Annual GHG Emissions**

The annual GHG report shall be submitted to MassDEP by each retail seller on BWP AQ 32, “Mandatory Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity.” The report shall include a spreadsheet provided by MassDEP showing the calculations required under 310 CMR 7.71(9)(c). Since the EFs change annually as the quantity and sources of electricity imported into and generated within Massachusetts change, an updated Form AQ 32 will be posted each year on the MassDEP website when final EFs have been determined.<sup>7</sup>

The spreadsheet to be provided by MassDEP as part of BWP AQ 32, “Mandatory Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity,” simplifies reporting for retail sellers. All retail sellers must report the total MWh they report to DOER (for competitive suppliers and electric utilities) or to DPU (for municipal electric departments and municipal light boards). Retail sellers who choose the simplest reporting approach (not adjusting for ownership and/or use of particular generation sources), need only enter the total MWh, and the spreadsheet will calculate the associated GHG emissions, with no further information required (note that the spreadsheet will calculate Massachusetts-based and Regional-based GHG emissions as explained further in the “Methodology and Data Sources” section of this document). Two optional types of information may be submitted (which must match any information submitted on Form AQ 31):

- Retail sellers making adjustments for the use of non-emitting MWh, must enter the non-emitting MWh, and the spreadsheet will calculate the total GHG emissions.
- Retail sellers making adjustments for the use of emitting MWh, must enter the emitting MWh, and the GHG emissions associated with the emitting MWh, and the spreadsheet will calculate the total GHG emissions.

### **Initial and Annual Reporting Years**

The initial reporting year for retail sellers occurred for emissions released in 2008. Annual reporting from retail sellers began with calendar year 2010 emissions released in the course of generating electricity consumed in 2010. Please note that reporting by retail sellers was not required for GHG emissions released in 2009.

### **Draft 2014 GHG EFs**

Table 1A contains the draft initial 2014 GHG EFs on which MassDEP is seeking comment. The spreadsheet in Appendix A contains the data and calculations described below and used to calculate the draft EFs.

Table 1A contains draft initial GHG EFs prior to accounting for the 2014 Form AQ 31 reporting of a retail seller’s ownership and/or use of particular generation sources. Calculation of the draft initial GHG EFs for 2014 can be found on the upper half of the ‘draft Emission Factors’ tab of the Appendix A: Draft 2014 Data and Calculations spreadsheet. The “combined” EFs shown in the tables below are provided for information only and are not to be used in the reporting of emissions by retail sellers.

Table 1A. Draft initial GHG Emission Factors for Electricity Consumed in Massachusetts in 2014 prior to accounting for optional Form AQ 31 submittals for ownership and/or use of particular generation sources (lb CO<sub>2</sub>e/MWh)

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<sup>7</sup> The 2014 GHG EFs were not posted on the usual schedule. The 2014 and the 2015 draft EFs are being posted together and retail sellers will report both their 2014 and 2015 emissions (on separate Form AQ32 reports) according to the schedule in Table 4 of the “Deadlines” section below.

	<b>Massachusetts-based approach</b>	<b>Regional-based approach</b>
Non-Biogenic	581	527
Biogenic	102	132
Combined	683	659

Table 1B contains draft final GHG EFs for 2014 that are calculated from the draft initial EFs and the MWh submitted on AQ 31 Forms. The EFs shown in Table 1B have been adjusted to account for generation that retail sellers chose to include on optional reporting Form AQ 31. Calculation of the draft final GHG EFs for 2014 can be found on the lower half of the ‘draft Emission Factors’ tab of the Appendix A: Draft 2014 Data and Calculations spreadsheet.

Once final, the EFs in Table 1B will be the EFs that retail sellers will use for their 2014 GHG emissions reporting.

Table 1B. Draft final GHG Emission Factors for Electricity Consumed in Massachusetts in 2014 after accounting for optional Form AQ 31 submittals for ownership and/or use of particular generation sources (lb CO<sub>2</sub>e/MWh)

	<b>Massachusetts-based approach</b>	<b>Regional-based approach</b>
Non-Biogenic	617	541
Biogenic	108	136
Combined	725	677

#### **Draft 2015 GHG EFs**

Table 1C contains the draft initial 2015 GHG EFs on which MassDEP is seeking comment. The spreadsheet in Appendix B contains the data and calculations described below and used to calculate the draft EFs.

Table 1C contains draft initial GHG EFs prior to accounting for the 2015 Form AQ 31 reporting of a retail seller’s ownership and/or use of particular generation sources. Calculation of the draft initial GHG EFs for 2015 can be found on the upper half of the ‘draft Emission Factors’ tab of the Appendix B: Draft 2015 Data and Calculations spreadsheet. The “combined” EFs shown in the tables below are provided for information only and are not to be used in the reporting of emissions by retail sellers.

Table 1C. Draft initial GHG Emission Factors for Electricity Consumed in Massachusetts in 2015 prior to accounting for optional Form AQ 31 submittals for ownership and/or use of particular generation sources (lb CO<sub>2</sub>e/MWh)

	<b>Massachusetts-based approach</b>	<b>Regional-based approach</b>
Non-Biogenic	602	536
Biogenic	102	139
Combined	704	675

Table 1D contains draft final GHG EFs for 2015 that are calculated from the draft initial EFs and the MWh submitted on AQ 31 Forms. The EFs shown in Table 1D have been adjusted to account for generation that retail sellers chose to include on optional reporting Form AQ 31. Calculation of the draft final GHG EFs for 2015 can be found on the lower half of the ‘draft Emission Factors’ tab of the Appendix B: Draft 2015 Data and Calculations spreadsheet.

Once final, the EFs in Table 1D will be the EFs that retail sellers will use for their 2015 GHG emissions reporting.

Table 1D. Draft final GHG Emission Factors for Electricity Consumed in Massachusetts in 2015 after accounting for optional Form AQ 31 submittals for ownership and/or use of particular generation sources (lb CO<sub>2</sub>e/MWh)

	Massachusetts-based approach	Regional-based approach
Non-Biogenic	640	552
Biogenic	109	143
Combined	749	695

MassDEP has also developed and posted 2006 - 2013 EFs using the procedures laid out in this document.

### Methodology and Data Sources for the calculation of the draft initial GHG EFs for 2014 and 2015

A number of steps were followed to calculate the four draft initial EFs presented in Tables 1A and 1C. Emissions released while generating electricity in each New England state and New York were determined as specified in steps 1 and 2 below, using available power plant data. Emissions released while generating electricity in New Brunswick and Quebec were determined as specified in step 3 below.

1. *Part 75 CO<sub>2</sub> emissions.* For certain units that reported CO<sub>2</sub> emissions in 2014 and 2015 under federal regulation 40 Code of Federal Regulations (CFR) Part 75, CO<sub>2</sub> emissions reported under Part 75 were used. Part 75 does not require separate reporting of CO<sub>2</sub> emissions by type of energy produced (steam vs. electricity) or fuel used (biogenic vs. non-biogenic). Therefore, CO<sub>2</sub> emissions reported under Part 75 by units co-generating steam and electricity or firing biogenic and non-biogenic fuels could not be used for this effort to determine electricity EFs for biogenic and non-biogenic fuels. CH<sub>4</sub> and N<sub>2</sub>O emissions released during the generation of electricity by Part 75 units were determined as in step 2 below.

2. *GHG emissions other than Part 75.* State level emissions of: CH<sub>4</sub> and N<sub>2</sub>O; CO<sub>2</sub> for Part 75 units not included in step 1 above; and CO<sub>2</sub> for non-Part 75 units, were determined by multiplying fuel-specific heat input by fuel- and pollutant-specific EFs (note that these fuel- and pollutant-specific EFs are distinct from the EFs in Tables 1A through 1D).

Heat input (in millions of British thermal units per year, or mmBtu) was obtained from the United States Department of Energy's Energy Information Administration's (EIA's) "Power Plant Operations" Form 923<sup>8</sup> on which certain facilities report the heat input used to make electricity. Final 2014 heat input data became available on EIA's website on October 28, 2015. Final 2015 heat input data became available on EIA's website on October 12, 2016.

Fuel-specific EFs (in pounds of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emitted per mmBtu combusted, or lb/mmBtu) came from a variety of sources. Best practice is to use the most geographically specific emissions or fuel-specific EFs available. Thus, unit-specific CO<sub>2</sub> emissions were used where available (as detailed in step 1 above). National fuel-specific EFs obtained from the EIA<sup>9</sup> and from EPA<sup>10</sup> were used where unit-specific

<sup>8</sup> Form available at <http://www.eia.gov/survey/#eia-923> and summarized data submitted available at [http://www.eia.doe.gov/cneaf/electricity/page/eia906\\_920.html](http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html)

<sup>9</sup> *Electric Power Annual 2014*, U.S. Energy Information Administration, released: February 2016 and *Electric Power Annual 2015*, U.S. Energy Information Administration, released: November 21, 2016. See Table A3 "Carbon Dioxide Uncontrolled Emission Factors" at [http://www.eia.gov/electricity/annual/html/epa\\_a\\_03.html](http://www.eia.gov/electricity/annual/html/epa_a_03.html).

<sup>10</sup> Fuel specific EFs from EPA's GHG Reporting Program (40 CFR Part 98 Subpart C Tables C-1 and C-2) were used for the 2014 and 2015 reports in instances where no EIA EF was available. <http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol21/pdf/CFR-2014-title40-vol21-part98-subpartC-appC.pdf> and

emissions were not available, and international fuel-specific EFs were used where unit-specific emissions or national EFs were not available. International EFs were obtained from the Intergovernmental Panel on Climate Change.<sup>11</sup> The attached Appendices A and B spreadsheets document the source and values of unit-specific, national or international CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions and EFs for each fuel for each state.

Multiplying heat inputs by fuel-specific EFs resulted in total non-Part 75 CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions released while generating electricity, per fuel and per state. The CO<sub>2</sub> emissions released from the combustion of biogenic fuels were summed per state, for use in calculating the biogenic EFs in Tables 1A through 1D. Separately, the CO<sub>2</sub> emissions released from the combustion of non-biogenic fuel, plus the CH<sub>4</sub> and N<sub>2</sub>O emissions released from the combustion of any fuel, plus the Part 75 non-biogenic CO<sub>2</sub> emissions available for certain units, were summed per state, for use in calculating the non-biogenic EFs in Tables 1A through 1D.

3. *New Brunswick and Quebec emissions.* Canadian non-biogenic GHG emissions released during the generation of electricity were obtained for each province from an Environment Canada report.<sup>12</sup> Canadian biogenic CO<sub>2</sub> emissions released during the generation of electricity were calculated by multiplying:

- the MWh of electricity generated from wood combustion obtained from Statistics Canada,<sup>13</sup>
- the same fuel-specific EF used in step 2 above, and
- an average heat rate.<sup>14</sup>

4. *Accounting for emissions from Massachusetts' imports of electricity.* The amount of electricity generated in 2014 by power plants located inside of Massachusetts was approximately 56 percent of the amount of electricity consumed in Massachusetts; the amount of electricity generated in 2015 by power plants located inside of Massachusetts was approximately 57 percent of the amount of electricity consumed in Massachusetts. The remaining 43 to 44 percent of electricity was generated outside of Massachusetts and imported from power plants located in other states and in Canada. Thus, the GHG emissions from the power plants located in Massachusetts do not represent the total GHG emissions associated with consumption of electricity in Massachusetts. As required by statute,<sup>15</sup> MassDEP requires

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<http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol21/pdf/CFR-2014-title40-vol21-part98-subpartC-appC-id656.pdf>

<sup>11</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: Energy at [http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2\\_Volume2/V2\\_2\\_Ch2\\_Stationary\\_Combustion.pdf](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf). See Chapter 2: *Stationary Combustion*, Table 2.2 “Default emission factors for stationary combustion in the energy industries (kg of greenhouse gas per TJ on a net calorific basis).”

<sup>12</sup> *National Inventory Report 1990–2014: Greenhouse Gas Sources and Sinks in Canada*, Environment Canada, April 14, 2016 at [http://unfccc.int/national\\_reports/annex\\_i\\_ghg\\_inventories/national\\_inventories\\_submissions/items/9492.php](http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php). And *National Inventory Report 1990–2015: Greenhouse Gas Sources and Sinks in Canada*, Environment Canada, April 13, 2017 at [http://unfccc.int/national\\_reports/annex\\_i\\_ghg\\_inventories/national\\_inventories\\_submissions/items/10116.php](http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php). See Table A13-5 “Electricity Generation and GHG Emission Details for New Brunswick” and Table A13-6 “Electricity Generation and GHG Emission Details for Quebec.”

<sup>13</sup> Table 127-0006 - *Electricity generated from fuels, by electric utility thermal plants, annual (megawatt hour)*, Statistics Canada, CANSIM (database), <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1270006&p2=17> (accessed on November 28, 2016).

<sup>14</sup> In the absence of province-specific heat rates, the average heat rate of wood-fired New England and New York electric generating units in 2014 and 2015 (as determined from EIA Form 923 data) was used.

<sup>15</sup> From GWSA, ““Statewide greenhouse gas emissions”, the total annual emissions of greenhouse gases in the commonwealth, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in the commonwealth, accounting for transmission and distribution line losses, whether the electricity is generated in the commonwealth or imported; provided, however, that statewide greenhouse gas emissions shall be expressed in tons of carbon dioxide equivalents.”

reporting that reflects all the GHG emissions associated with generation of the electricity consumed in the state.

Calculating the EFs requires electric-generating sector GHG emissions data in each of the six New England states and in each of the electricity grid control areas adjacent<sup>16</sup> to New England that may send power to New England, determined as described in steps 1 to 3 above. In addition to state- and province-level GHG emissions, one approach to calculating the EFs requires the MWh of electricity generated and consumed in each New England state, and imported from adjacent control areas, which is available from the region's independent system operator, ISO New England, which manages the New England electricity grid.<sup>17</sup>

There are a variety of methods that can be used to estimate the emissions due to Massachusetts' consumption of electricity, including emissions associated with electricity generated out-of-state. MassDEP believes it is appropriate to consider GHG emissions associated with electricity consumption in state-specific and regional contexts, since, due to the linked, regional nature of the New England electricity grid, electricity generated in a state is not necessarily consumed in that state, even if that state is a net importer of electricity.

Therefore, Tables 1A through 1D and the Appendix A and Appendix B spreadsheets present two sets of draft biogenic and non-biogenic EFs to account for emissions associated with electricity consumed in Massachusetts. The first "Massachusetts-based" set of EFs assumes that all electricity generated in Massachusetts is used in Massachusetts. Thus, these EFs are based on all emissions from Massachusetts power plants, plus a portion of emissions from power plants in the other New England states that generate more electricity than they use in a given year and in the adjacent control areas (New York, New Brunswick, Quebec) in years that New England receives net imports of electricity from those control areas.

Under this "Massachusetts-based" approach, emissions due to Massachusetts' consumption of imported electricity were determined by apportioning to Massachusetts a share<sup>18</sup> of any excess generation (and associated emissions) from each New England state that generates more electricity than it uses. Thus, the Massachusetts-based draft EFs include a share of the emissions associated with each electricity-exporting state's exported electricity, as calculated from emissions as discussed in steps 1, 2 and 3 above. Similarly, the approach apportions to Massachusetts a percentage of the megawatt hours of losses (and associated emissions) due to pumped hydro<sup>19</sup> and of the net annual imports into the ISO New England grid from the

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<sup>16</sup> The control areas adjacent to New England that could send power to New England are New York, Quebec and New Brunswick.

<sup>17</sup> Electric sector GHG emissions determined as described in steps 1 and 2 include the entire state of Maine, while ISO New England load for Maine in the attached spreadsheet does not include the part of Maine supplied by the Northern Maine Independent System Administrator (NMISA). Northern Maine load and generation data were obtained from NMISA to estimate the ISO New England and NMISA fractions of Maine's total generation, to pro-rate Maine's electric sector GHG emissions.

<sup>18</sup> Generally, the emissions associated with electricity from exporting states are assigned proportionately to importing states. For example, in 2014, MA, ME, and CT all generated less electricity than they used (MA, ME and VT in 2015), while NH, RI, and VT (NH, RI, and CT in 2015) generated more electricity than they used (and New York, New Brunswick and Quebec sent electricity to New England). Massachusetts' MWh needs were 83% of the sum of MWh needed by MA, ME and CT. Therefore, 83% of the excess generation (and associated emissions) from NH, RI, VT, New York, New Brunswick and Quebec were apportioned to MA; in 2015, 76% of excess generation from NH, RI, CT, New York, New Brunswick and Quebec were apportioned to MA.

<sup>19</sup> The megawatt hours of losses associated with pumped hydro were obtained from ISO-NE. The megawatt hours of losses associated with pumped hydro were apportioned to each New England state according to that state's fraction of total New England load.



New York, New Brunswick and Quebec grids.

The second “Regional” set of EFs is based on the fraction of New England electricity (in MWh) that is consumed in Massachusetts. Massachusetts is then assumed to be responsible for that same fraction of the GHGs emitted while generating that electricity. Thus, these EFs are based on the total of New England GHG emissions from electricity generation plus GHG emissions associated with electricity imported from the adjacent control areas (New York, New Brunswick, Quebec) in years that New England receives net imports of electricity from those control areas; this total is multiplied by the ratio of Massachusetts to New England electricity consumption.

Table 2 below summarizes the information found on each tab of the spreadsheets in Appendix A and Appendix B used to calculate draft EFs.

Table 2. Information presented on each tab of the Appendix A and Appendix B spreadsheets to calculate 2014 and 2015 Emission Factors

Tab	Contents
1 “Form 923 Generation and Fuel Data”	2014 and 2015 heat input by unit and fuel from EIA Form 923 totaled by state and fuel type and used to calculate GHG emissions on Tab 4
2 “EPA Part 75 data”	2014 and 2015 CO <sub>2</sub> emissions data from EPA for Part 75 units (used in place of calculating CO <sub>2</sub> from EIA fuel data on Tab 1) included on Tab 4
3 “GWPs and EFs”	Includes the following EFs used to calculate emissions on Tab 4: EIA’s CO <sub>2</sub> EFs by fuel type used where available to calculate CO <sub>2</sub> emissions, EPA’s GHG EFs by fuel type used to calculate CO <sub>2</sub> emissions where EIA data was not available and to calculate CH <sub>4</sub> and N <sub>2</sub> O emissions, and IPCC GHG EFs by fuel type used to calculate GHG emissions where EIA and EPA factors were not available. The heat trapping [global warming] potentials (GWPs) of each gas from IPCC’s Fourth Assessment Report (AR4) were used to calculate the EFs for 2014 and 2015 reporting.
4 “Calculating CO <sub>2</sub> e”	Calculation of CO <sub>2</sub> e emissions from CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O by state and Canadian province used to calculate the draft EFs on Tab 6
5 “ISO load-generation-imports”	2014 and 2015 Generation and Load data from ISO New England used to calculate the draft EFs on Tab 6
6 “draft Emission Factors”	Calculation of draft initial and final Massachusetts-Based and Regional Biogenic and Non-Biogenic EFs for 2014 and 2015, and a table showing the 2014 and 2015 non-emitting MWh submitted in AQ 31 forms by State and generator/meter type.

#### Methodology for the calculation of the draft final GHG EFs for 2014

Thirty-five retail sellers submitted AQ 31 Forms to MassDEP accounting for the ownership and/or use of particular generation sources in 2014 totaling over 3.5 million non-emitting MWh. None of the forms submitted included emitting MWh. Table 3A shows the breakdown of the non-emitting 2014 generation submitted on AQ 31 Forms by fuel type.

Table 3A. Non-Emitting 2014 Generation submitted on AQ 31 Forms by Fuel Type<sup>20</sup>

Fuel Type	MWh	%
Hydro	659,576	19%
Nuclear	1,336,781	38%
Photo Voltaic	258,993	7%

<sup>20</sup> The percentages do not quite total to 100% due to rounding.

Wind	1,300,160	37%
TOTAL	3,452,683	100%

Calculation of the draft final GHG EFs for 2014 can be found on the 'draft Emission Factors' tab of the Appendix A: Draft 2014 Data and Calculations spreadsheet.

### Methodology for the calculation of the draft final GHG EFs for 2015

Forty-seven retail sellers submitted AQ 31 Forms to MassDEP accounting for the ownership and/or use of particular generation sources in 2015 totaling over 3.6 million non-emitting MWh. None of the forms submitted included emitting MWh. Table 3B shows the breakdown of the non-emitting 2015 generation submitted on AQ 31 Forms by fuel type.

Table 3B. Non-Emitting 2015 Generation submitted on AQ 31 Forms by Fuel Type

Fuel Type	MWh	%
Hydro	690,356	19%
Nuclear	1,465,285	40%
Photo Voltaic	500,291	14%
Wind	1,003,706	27%
TOTAL	3,659,638	100%

Calculation of the draft final GHG EFs for 2015 can be found on the 'draft Emission Factors' tab of the Appendix B: Draft 2015 Data and Calculations spreadsheet.

The following adjustments were made to the draft initial GHG EFs to account for Form AQ 31 submissions for 2014 and 2015 in the calculation of the draft final GHG EFs for 2014 and 2015:

1. MWh from behind-the-meter non-ISO New England-tracked generators in each New England state were not included in the data on the 'ISO load-generation-imports' tab and therefore were not included in the calculation of the draft initial GHG EFs. To account for these MWh and allow the retail seller(s) to claim them, these MWh were added to the amount of MWh in 'MA Electric Generation' (Column D), 'ME Electric Generation' (Column W), 'NH Electric Generation' (Column AF), 'VT Electric Generation' (Column AO), 'CT Electric Generation' (Column AX), and 'RI Electric Generation' (Column BG). This increased the amount of MWh generated by each state and reduced the amount of MWh MA needed to import to meet its load in 'MA Electricity Imports [Gen-Load]' (Column H).

Some net metered facilities in MA have both an MSS and a non-ISO meter both of which may be metering the same/overlapping MWh (with the MWh from the non-ISO meter being used for the purpose of generating RPS credits in GIS). Although the amount of MA non-ISO MWh claimed by retail sellers in 2014 and 2015 is minor, it is large enough to slightly alter the 2015 draft final EF (by 1 lb/MWh for the MA-Based non-biogenic EF). Therefore, to minimize the amount of potential double counting from these facilities, Column D includes only the portion of MWh from facilities having only a non-ISO meter (since MWh from MSS meters are already included in the data on the 'ISO load-generation-imports' tab).

2. Some non-emitting MWh submitted on AQ 31 Forms were from generators in CT, VT, and ME. However, CT and ME were not net electricity exporters in 2014, and ME and VT were not net electricity exporters in 2015; therefore, no MWh from CT or ME were included in the amount of MWh imported into MA in the draft initial 2014 GHG EFs, or from ME or VT for the draft initial 2015 GHG EFs. To account for these MWh and allow the retail seller(s) to claim them, the MWh from these states were subtracted from the amount in 'MA Electricity Imports [Gen-Load]' (Column H). This reduced the

amount of MWh required by MA from the net exporting states/provinces and therefore the percentage of the imported power that went to MA in ‘MA Fraction of Imports’ (Column J).

3. Finally, all of the non-emitting MWh submitted on AQ 31 Forms were subtracted from the denominator of the calculation of each of the draft final ‘MA-Based GHG Emission Rates’ (Column T) and ‘Regional GHG Emission Rates’ (Column CT) for 2014 and 2015 to determine the draft final 2014 and 2015 EFs in Tables 1B and 1D.

### **Deadlines**

In order to finalize the annual biogenic and non-biogenic EFs, the regulation at 310 CMR 7.71(9)(b)3. requires MassDEP to:

- a. post draft annual EFs, including methodologies and data sources, on its website for public comment for 30 days and notify retail sellers of the posting and of the deadline for submittal of public comment; and,
- b. post final annual EFs, including methodologies and data sources, on its website and notify retail sellers of the posting and of the deadline for the mandatory Form AQ 32 submittals.

This document and the attached spreadsheets have been posted as part of complying with step “a” of these requirements. MassDEP has also sent notice of the posting of the draft EFs to the most recent e-mail address it has for each retail seller. If you are a retail seller and you did not receive this information directly from MassDEP, please provide your contact information to Sue Ann Richardson at [sue.ann.richardson@state.ma.us](mailto:sue.ann.richardson@state.ma.us).

The deadlines for submitting public comment on the draft EFs for 2014 and on the draft EFs for 2015, and for retail sellers to submit Form AQ 32 for 2014 and for 2015, are summarized in Table 4 below. Public comments are to be submitted as specified in the Introduction above.

Table 4. Deadlines associated with retail seller GHG reporting

Year MWh generated and emissions released	Draft EFs public comment deadline	Mandatory Form AQ 32 submittal deadline
2010 and beyond	30 days after draft EFs are posted on MassDEP’s website	The first day of the next month that is a full calendar month after MassDEP posts the final annual EFs on its website

### **Determining final EFs**

MassDEP solicits comments on the methodology, data sources, and calculations used to produce the draft initial 2014 and the draft initial 2015 EFs.

In determining the final 2014 and 2015 EFs, MassDEP will consider comments received on the methodology, data sources and calculations used to produce the draft initial EFs. After determining the final EFs, MassDEP will post the final 2014 and the final 2015 EFs, including methodologies and data sources, on its website and notify retail sellers of the posting. All retail sellers must report 2014 and 2015 GHG emissions by submitting a separate BWP AQ 32, “Mandatory Greenhouse Gas Emissions Reporting Form for Retail Sellers of Electricity” for each emissions year, by the deadline specified in Table 4. Form AQ 32 will be posted on the MassDEP website at the same time as the final EFs. Separate AQ 32 spreadsheets will be posted for 2014 and 2015, containing their respective final EFs.

Appendix A: Draft 2014 Data and Calculations spreadsheet.  
Appendix B: Draft 2015 Data and Calculations spreadsheet.